

## PLATING METHOD AND PLATING APPARATUS

[0001]

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to a plating method and a plating apparatus.

[0002]

#### 2. Description of Related Art

Conventionally, when electric components such as a connector terminal or small parts of automobile body are plated, those components are taken into a cage and dipped into plating solution or hung by a hook or a similar device and plated.

[0003]

Japanese Patent Application Laid-Open No.2002-220690 has disclosed such a conventional technology.

When small parts are plated, those parts collide with each other during plating treatment, so that deformation often occurs, which is a problem to be solved.

[0004]

Further, in case of a small part, after plating a sheet material, that part is punched out into a predetermined shape with a press machine. In case of such formation by punching with the press machine after plating treatment, most plated section is thrown away, which is a great waste. Additionally, its shearing section is free of plating treatment and thus, that part is insufficiently plated, which is another problem to be solved.

[0005]

### SUMMARY OF THE INVENTION

The present invention has been achieved in views of the above-described problems and an object of the present invention is to provide a plating method and a plating apparatus capable of plating electric parts or small parts of automobile

effectively without any deformation. A first aspect of the present invention concerns a plating method comprising putting an object product to be plated in each accommodating concave portion in a carrier tape which has a number of spaced accommodating concave portions and passing that object product to be plated through a plating apparatus by feeding the carrier tape so as to form metallic plating layer on the surface of the object product to be plated.

[0006]

According to a second aspect of the present invention, there is provided the plating method wherein washing units are disposed in the upstream and downstream of the plating apparatus and the object product to be plated is passed through each washing unit and washed.

[0007]

According to a third aspect of the present invention, there is provided a plating apparatus comprising a feeding mechanism for the carrier tape containing a number of accommodating concave portions each capable of keeping an object product to be plated and a cell so constructed that the carrier tape can pass through plating solution and the cell is provided with a cathode member for supplying the object product to be plated with electricity.

[0008]

According to a fourth aspect of the present invention, there is provided the plating apparatus wherein each accommodating concave portion in said carrier tape includes an opening which allows plating solution to flow in and out and said cathode member to invade.

[0009]

#### BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a schematic arrangement diagram provided by the plating method which plates continuously by feeding a carrier

tape;

FIG. 2 is a perspective structure diagram of the carrier tape when viewed from its front side;

FIG. 3 is a perspective structure diagram of major portions in the carrier tape as viewed from its rear side;

FIG. 4 is a perspective structure diagram showing a condition in which the carrier tape is fed while it is supported by a cathode member provided in a cell;

FIG. 5 is a schematic enlarged structure diagram showing the condition of FIG. 4; and

FIG. 6 is a partially broken perspective structure diagram showing the interior of the cell so constructed that the cathode member is provided above the same cell so as to feed the carrier tape in a upside down condition.

[0010]

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, the preferred embodiment of the present invention will be described with reference to the accompanying drawings.

FIG. 1 shows schematic arrangement diagram of a plating apparatus, in which a washing unit 1 filled with alkaline solution such as sodium hydrate solution, a plating unit 2 filled with plating solution, a washing unit 3 filled with water or the like, and a drying unit 4 are disposed in succession from an upstream to a downstream. Sprockets 6, 6, 6 are disposed to construct a feeding mechanism for the carrier tape 5 so that the carrier tape 5 can be passed through insides of the respective units 1, 2, 3, 4. When these feeding sprockets 6, 6, 6 are rotated, the carrier tape 5 is fed successively from the upstream to the downstream. After plating and drying, the carrier tape 5 is wound around a reel 7.

[0011]

In this carrier tape 5, a number of accommodating concave portions 51, 51, 51 are formed and then, an object product to be plated W such as a small electric part or automobile part is placed into each accommodating concave portion 51 on the upstream of the washing unit 1.

After the object products to be plated W, W, W are placed in respective accommodating concave portions 51, 51, 51 and the carrier tape 5 is fed out by rotations of the sprockets 6. In this process, when the carrier tape 5 is passed through the washing unit 1, the object product to be plated W accommodated in the accommodating concave portion 51 is degreased and washed with sodium hydrate solution or the like. Next, the same product is advanced into the plating unit 2, in which metallic plating layer is formed on the surface of the object product to be plated W. After that, it is passed through the washing unit 3 so as to wash off the plating solution and then, when it is passed through the drying unit 4, the object product to be plated W is dried excellently. Consequently, the plating on the object product to be plated can be carried out continuously and finally, the carrier tape 5 can be wound around the reel 7 with the plated products W accommodated in the respective accommodating concave portions 51. Then, the carrier tape 5 wound around the reel 7 is transported to plant as it is and loaded on a charging unit disposed on electronic products or automobile part production line. By feeding the carrier tape 5 successively from the reel 7, the plated products W are taken out successively and installed on an electric product or the like.

[0012]

Therefore, according to the present invention, the object products to be plated W can be plated in a condition that they are accommodated in the carrier tape 5 and thus, no deformation or damage occurs in those object products to be plated W during the plating treatment and such small parts can be plated very

effectively.

Additionally, after that, the plated products W can be fed to the charging unit continuously in a condition that they are accommodated in the carrier tape 5.

[0013]

FIG. 2 shows a perspective view of major portions indicating an example of the carrier tape 5 and FIG. 3 shows a perspective view of the rear side of the carrier tape 5.

The carrier tape 5 is constructed of resin excellent in heat resistance and chemical resistance having two layers or multiple layers formed by coextrusion. Each accommodating concave portion 51 is formed into a concave shape corresponding to the shape of the object product to be plated W. A pair of slip-out preventing pieces 52, 52 are provided on a top face of the accommodating concave portion 51 such that the center portions of those pieces 52, 52 are tilted downward and oppose each other in order to prevent the object product to be plated W from dropping out when the same object products to be plated W are put into the accommodating concave portions 51.

The bottom portion and side portions of the accommodating concave portion 51 are cut out at positions of the slip-out preventing pieces 52, 52 so that a through opening 53 is formed. The through opening 53 in the respective accommodating concave portion 51 is formed continuously in the longitudinal direction of the carrier tape.

[0014]

Narrow slits 54, 54 are formed through at least in the bottom and side faces of each accommodating concave portion 51 so that washing solution or plating solution escapes easily.

Further, the washing solution or plating solution can flow into the accommodating concave portion 51 excellently through the opening 53 and the slits 54, so that the washing solution or plating solution can flow into or out the accommodating concave

portion 51 easily.

[0015]

When the object product to be plated W is put into each accommodating concave portion 51, if the object product to be plated W is pressed into the accommodating concave portion 51, the slip-out pieces 52 are pressed downward elastically and restored to its upper face of the object product to be plated W. As a result, the top face of the object product to be plated W is pressed excellently so that the object product to be plated W is prevented from dropping from the accommodating concave portion 51.

Feeding holes 55, 55 are formed through on both sides in the width direction of the carrier tape 5 at a specific interval in the length direction. Said feeding sprocket 6 engages these feeding holes 55, 55 and when the feeding sprocket 6 is rotated, the carrier tape 5 is fed successively from the upstream to the downstream.

[0016]

FIG. 4 shows a schematic structure diagram of the plating unit 2 and the plating unit 2 contains a cell 8 filled with plating solution and a cathode member 9 is provided within this cell 8.

This cathode member 9 is provided from the upstream to the downstream in the cell 8 along the flow direction of the carrier tape 5 and connected to a cathode of an outside power supply.

In addition, a copper plate 10, connected to an anode of a power supply, is disposed on a side of the cell 8.

[0017]

In case where the copper plate 10 is disposed, the object product to be plated W is plated with copper and the cell 8 is filled with plating solution 11 composed of copper sulfate solution.

When the carrier tape 5 is fed successively in the plating solution 11, the cathode member 9 is fit to the opening 53 in the carrier tape 5 and then, the carrier tape 5 is fed from the upstream to the downstream along the cathode member 9 in a condition that the carrier tape 5 rides on the cathode member 9.

[0018]

FIG. 5 is a schematic structure diagram showing the condition in the plating solution in enlargement. The top face of the object product to be plated W accommodated in each accommodating concave portion 51 in the carrier tape 5 is pressed to the slip-out preventing pieces 52, 52. Consequently, the cathode member 9 invades into the opening 53 so that this cathode member 9 comes into a contact with the bottom face of the object product to be plated W accommodated in each accommodating concave portion 51. At this time, minus current is supplied to the object product to be plated W through the cathode member 9, so that the object product to be plated W is charged with negative electricity.

[0019]

Therefore, the copper plate 10 on the anode side is dissolved and copper plating layer is formed on the surface of each object product to be plated W successively.

For example, if the carrier tape 5 is fed slowly in the cell 8 such that it is dipped in the plating solution 11 for about 10 minutes, copper plating is achieved on each object product to be plated W excellently within the cell 8.

In case where nickel plating is carried out in the plating unit 2, the plating solution 11 is nickel sulfate solution and instead of the copper plate, a nickel plate is employed. Additionally, silver plating, gold plating, galvanization, chrome plating and the like can be carried out in similar ways.

[0020]

FIG. 6 shows a modification, in which the carrier tape 5 is fed in an upside down condition (state shown in FIG. 3) through the plating solution in the cell 8. FIG. 7 shows a schematic diagram indicating enlarged major parts.

In this case, the bottom face of each object product to be plated W is supported by a pair of the slip-out preventing pieces 52, 52 so that the object product to be plated W is prevented from dropping out. Further, because the opening 53 is disposed on the side of the top face of the object product to be plated W, if the cathode member 9 from which a number of brushes 9a, 9a, 9a capable of invading into the opening 53 is provided above the cell 8, minus current is supplied to each object product to be plated W through each brush 9a from this cathode member 9. Consequently, each object product to be plated W turns to a cathode so that the surface is plated excellently.

[0021]

With such a configuration, the cathode member 9 can be disposed outside the plating solution 11.

In this example, in a process in which the carrier tape 5 is fed successively from the upstream to the downstream in the plating solution 11 within the cell 8, plating layer is formed on the surface of each object product to be plated accommodated in each accommodating concave portion 51.

[0022]

According to the plating method of the present invention, because the object product to be plated is put into each accommodating concave portion in the carrier tape including a number of the accommodating concave portions spaced at a specific interval and the carrier tape is fed through the plating unit so as to form metallic plating layer on the surface of the object product to be plated, the object product to be plated can be plated effectively in a condition that it is accommodated in the carrier tape without damaging or deforming small electric

parts or automobile parts. Consequently, the plating treatment can be carried out continuously and effectively while the carrier tape is fed. Additionally, the carrier tape can be used by a charging unit in plant or the like just as it is and the effectively plated products can be transferred to a next production stage without any delay.

[0023]

Further because the washing units are disposed in the upstream and downstream of the plating unit and each object product to be plated is washed when it passes through each washing unit, washing in a process before plating and washing in a process after plating can be carried out continuously in a condition that the object product to be plated is kept in the carrier tape.

[0024]

Further because the plating unit of the present invention includes a feeding mechanism for the carrier tape containing a number of the accommodating concave portions each capable of keeping the object product to be plated and the cell so constructed that the carrier tape can pass through the plating solution and that cell is provided with the cathode member which supplies the object product to be plated with electricity, when the carrier tape is passed through the plating solution in the cell in a condition that the object product to be plated is kept in each accommodating concave portion, the object product to be plated is charged with negative electricity through the cathode member. Consequently, metallic plating layer can be formed excellently on the surface of the object product to be plated in the cell.

[0025]

Because the plating solution can flow in and out of each accommodating concave portion in the carrier tape and additionally, the opening which allows the cathode member to invade is formed, the cathode member comes into a contact with the object product to be plated accommodated in the accommodating

concave portion, so that the object product to be plated is charged with negative electricity excellently. Further, because the plating solution can flow in and out through the opening excellently, the object product to be plated in each accommodating concave portion can undergo excellent plating treatment.